SHARP

SCIENTIFIC CALCULATOR
WISSENSCHAFTLICHER RECHNER
CALCULATRICE SCIENTIFIQUE
CALCULADORA CIENTIFICA
CALCOLATRICE SCIENTIFICA

MODEL
MODELL
MODELE
MODELO
MODELLO

EL-545

INSTRUCTION MANUAL
BEDIENUNGSANLEITUNG
MODE D'EMPLOI
MANUAL DE INSTRUCCIONES
MANUALE DELLE ISTRUZIONI

ENGLISH

CONTENTS

INTRODUCTION

Thank you for your purchase of the SHARP scientific calculator, model EL-545.

This manual will introduce you to the Sharp EL-545 scientific calculator.
Each section in this manual may be divided into basic and advanced material. The advanced material is labeled "supplementary." The supplementary sections may be skipped without hampering your ability to operate the calculator. You may wish to return to the supplementary sections as your skill in operating the EL-545 increases.

Please press the ON/CA key whenever you see no indication, or meaningless figures or signs despite sufficient light after opening the leatherette case.

OPERATIONAL NOTES

Since the liquid crystal display is made of glass material, treat the calculator with care. Do not put the "EL-545" in your back pocket as it may be damaged when you sit down.

To insure trouble-free operation of your SHARP calculator, we recommend the following:

1. The calculator should be kept in areas free from extreme temperature changes, moisture and dust.
   During summer weather, vehicles left in direct sun light are subject to high temperature build up.
   Prolonged exposure to high temperature may cause damage to your calculator.
2. A soft, dry cloth should be used to clean the calculator. Do not use solvents or a wet cloth.
3. The solar cell is delicate. It should not be pressed or tampered with.

4. If service of your calculator is required, use only an authorized SHARP service center.
5. Keep this manual for further reference.

FEATURES

1. **Solar Cell Power**
   Virtually all types of light supply power to the EL-545 solar cell scientific calculator: artificial light including fluorescent and incandescent light, and sunlight striking the EL-545 outdoors or through a window indoors.

2. **Scientific Functions**
   - **Direct formula entry**
     Direct formula entry for entering formulas as they are written with no need for translation into machine language.

     Example $5 + 2 \times \sin 30 + 24 \times 5^3 =$

Operation [5] [+] [2] [×] [3] [0] [sin] [+] [2] [4]
[×] [5] [y^x] [3] [=]

15 levels of parentheses and 4 levels of pending operations for solving more complicated formulas.

- **Binary, Octal, and Hexadecimal Calculations**
  Binary, Octal, and Hexadecimal numbers are mainly used in computer programming. Computer engineers and programmers have been in urgent need for a simple conversion and calculation of Binary, Octal, and Hexadecimal numbers. Now EL-545 has solved the problem. Simply enter numbers in base 2,8, or 16, the EL-545 will then give you the answer instantly.

- **Complex Number Calculations**
  The EL-545 allows you to calculate complex numbers which are often used for electrical or mathematical calculation. When combined with the coordinate conversion feature, the complex number calculation feature lets you calculate the absolute value of complex numbers, deviation angles, and vector composition.

- **Preprogrammed for 56 Functions**
  Trigonometric, inverse trigonometric, logarithmic, hyperbolic, inverse hyperbolic, statistical, random number generation and others.

3. Useful Keys for Solutions of Math Problems

- Statistical calculations with statistical mode [STAT], number of samples/Σx [$n\Sigma x$], mean/Σx^2 [$\bar{x}\Sigma x^2$], standard deviation [$s\sigma$], enter data/correct data [DATA CD] keys.
- Independently accessible memory. (x⇌M , RM , M+)
- DEG/RAD/GRAD selector key. (DRG)
- Angular unit conversion key. (2ndF DRG)
- Degree/Minute/Second conversion key for decimal degree transformation. (°'" →DEG)

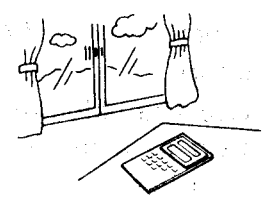
POWER SUPPLY

This calculator has a solar cell and is energized by electrical energy produced by the solar cell.
The solar cell converts luminous energy directly into electrical energy by utilizing the photovoltaic effect.

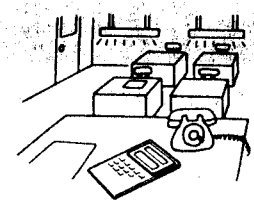
Brightness for operation
If the light exposed to the solar cell is insufficient, the calculator is not powered to operate. With the brightness criterion below, operate the calculator **at 50 lux or more.**

Hints on the use of the EL-545:

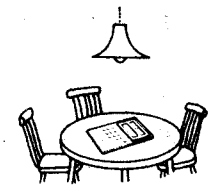
1. When the EL-545 is used outdoors or by the window:
   Use the calculator where it is not exposed to direct sunlight but received enough illumination for comfortable reading.



2. When the EL-545 is used in an office:
   Use the calculator wherever there is enough illumination for normal working.



3. When the EL-545 is used under the light of an incandescent lamp:
   Use the calculator wherever it receives the same illumination as attained within 2.5 meters of a 100 Watts incandescent lamp.



4. When the EL-545 is used under the light of a fluorescent lamp:
   Use the calculator wherever it receives the same illumination as attained within 1.5 meters of a 15 Watts fluorescent lamp.

Note:
- When you open the leatherette case, depress the ON/CA key and check that the display indicates " DEG 0." before attempting any calculation. If the display does not give the proper indication, press the ON/CA key again. (The calculator may display insignificant numeric value or symbol when something is placed over the solar cell. If such is encountered, make the above operation as well.)
- When depressing the keys it is possible that the display may disappear due to a shortage of light. If this happens move the calculator until adequate light is again obtained, press the ON/CA key and start again.

NORMAL CALCULATIONS

TURNING THE POWER ON

Opening the EL-545 in adequate light will turn its power on.
Before starting calculation, press the Clear All (ON/CA) key to set the calculator in the initial condition.

EL-545 can designate the decimal places of an answer. To floating decimal system in this chapter, depress the [2ndF] , [TAB F↔E] and [•] keys. (Details, see "Decimal Places")

CLEARING

[CE], [→]

An incorrectly entered number can be replaced as long as the number has not already been followed by a "function key." Pressing the clear entry key will clear the latest entry while retaining all previous entries.
For example:
Key in: 5 [×] 4 (The 4 should be 6)

Key in: [CE] 6 [=]
Answer: 30

If the [C] key is pressed the calculator will be clared except for material in memory.

If the [CA] key is pressed the calculator will be completely cleared all material including memory.

In case of one digit correction of the entered number, use the right shift key.

Key in: 123 [+] 12345687 (The 87 should be 78)
Key in: [→] [→] 78 [=]
Answer: 12345801

BASIC FUNCTIONS AND THE EQUALS KEY

[+] [−] [X] [÷] [=] Addition, Subtraction, Multiplication, Division, Equals

1. Addition, Subtraction

Key in: 123 [+] 456 [+] 789 [=] Answer: 1368
Key in: 100 [−] 25 [−] 35 [=] Answer: 40

Pressing the [=] key gives the answer to the entered formula.

Using a constant:

The calculator is equipped with a built-in constant feature which allows repetitive calculations (calculating with the same number without having to re-enter that number and the function key).

Key in: 10 [+] 20 [=] Answer: 30

20 is now a constant for further additions:

Key in: 60 [=] Answer: 80

> Some calculations require slightly longer time depending on the contents. If nothing appears on the display during calculation do not continue making entries.

To use the sum of numbers as a constant use [(] and [)] keys.

Key in: 10 [+] [(] 20 [+] 5 [)] [=] Answer: 35

Key in: 4 [=] Answer: 29

Key in: 100 [−] 25 [=] Answer: 75
Key in: 40 [=] Answer: 15
Key in: 50 [−] [(] 10 [−] 2 [)] [=] Answer: 42
Key in: 20 [=] Answer: 12

2. Multiplication, Division

Calculate: 50 x (−2) ÷ 4

Key in: 50 [×] 2 [+/−] [÷] 4 [=]

Note: To enter a negative number, press the [+/−] key after numerals.

Answer: −25

Calculate: 5 + 2 x 3 − 2 ÷ 0.5

Key in: 5 [+] 2 [×] 3 [−] 2 [÷] .5 [=]

Answer: 7 ↑—(Press [•])

Note that multiplication and division have priority to addition and subtraction. In other words multiplication and division will occur before addition and subtraction.

Constant Multiplication: The first number entered is the multiplicand.

Key in: 3 [×] 5 [=] Answer: 15

Key in: 10 [=] Answer: 30

Constant Division: The number entered after the division sign is the divisor.

Key in: 15 [÷] 3 [=] Answer: 5

Key in: 30 [=] Answer: 10

Note: The machine retains some calculations depending on priority level. Accordingly, in successive calculation the operator of the last calculation and the last numerical value are handled as a calculating instruction and a constant for constant calculation, respectively. (except constant multiplication)

$a + b \times c =$ $+bc$ (Constant addition)

$a \times b \div c =$ $\div c$ (Constant division)

$a \times b - c =$ $-c$ (Constant subtraction)

In constant multiplication the first numerical value is handled as a constant.

$a \div b \times c =$ $\frac{a}{b} \times$ (Constant multiplication)

3. Use of parenthesis

The parentheses keys are needed to cluster together a series of operations when it is necessary to override the priority system of algebra. When parentheses are in use on the EL-545 the symbol ( ) will appear in the display.

Calculations in parentheses have priority over other calculations. Parentheses can be used up to 15 times in a single level. Calculations within the inner-most set of parentheses will be calculated first.

Calculate: $12 + 42 \div (8 - 6)$

Key in: 12 [+] 42 [÷] [(] 8 [−] 6 [)] [=]

Answer: 33

Calculate: $126 \div [(3 + 4) \times (3 - 1)]$

Key in: 126 [÷] [(] [(] 3 [+] 4 [)] [×] [(] 3 [−] 1 [)] [)] [=]

Answer: 9

can be omitted

Note: The [)] keys located just before the [=] or [M+] key can be omitted. But the opening parenthesis, [(] , must be entered.

Supplementary 1 — priority level

The machine, provided with a function that judges the priority level of individual calculations, permits keys to be operated according to a given mathematical formula.

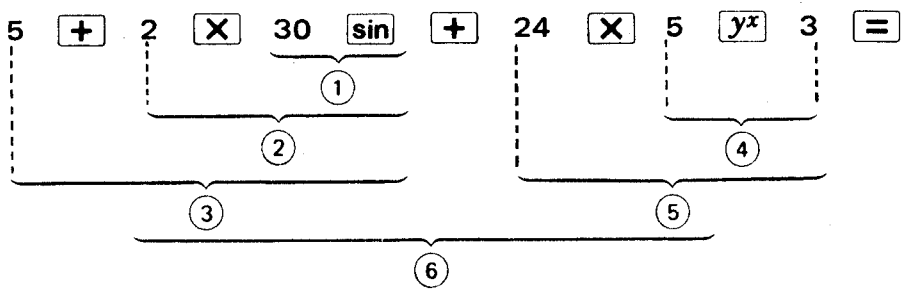
The following shows the priority level of individual calculations.

Level	Operations	
(1)	Functions, such as sin, x^2, and %	
(2)	y^x, $\sqrt[x]{y}$	
(3)	x, ÷	(Calculations which are given the same priority level are executed in sequence.)
(4)	+, —	
(5)	=, M+	

The calculation in parentheses has priority to others.

Ex. Key operation and sequence of calculation in $5 + 2 \times \sin 30 + 24 \times 5^3 = 3{,}006$

Put the angular mode at "DEG" by pressing [DRG] key.



The numbers ① ~ ⑥ indicates the sequence in which the calculations are carried out.

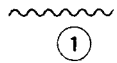
When calculations are executed from higher priority one in sequence a lower priority one must be reserved. The machine is provided with memories of 4 levels to meet such requirement.

As the memories can also be used in a calculation including parentheses, calculation can be performed according to a given mathematical formula unless parentheses and pending operation exceed 4 levels in total.

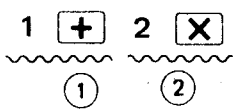
- Parenthesis [( ] key can be operated up to 15 times in 1 level.
- Functions are calculated immediately after key operation without being retained. (x^2, $1/x$, n!, →DEG, →D.MS, etc.)
- In calculations including no parentheses, pending does not occur beyond 3 levels.

〈 Calculation without using parentheses 〉

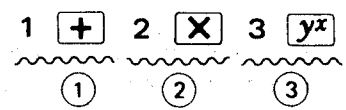
Ex. 1 [+] 2 — Pending of 1 level



1 [+] 2 [×] 3 — Pending of 2 levels



1 [+] 2 [×] 3 [y^x] 4 — Pending of 3 levels



1 [+] 2 [×] 3 [y^x] 4 [÷] 5

① ② ③

②

With the [y^x] pressed, 3 calculations remain pending. Pressing the [÷] key executes the calculations of "y^x" highest in priority level and "x" identical in priority level. After the [÷] key is pressed, the other 2 calculations will remain.

〈 Calculation using parentheses 〉

Ex. i) 1 [+] 2 [×] 3 [y^x] [(] 4 [÷] 5

① ② ③ ④

4 numerals and calculation instructions are left pending.

ii) 1 [+] 2 [×] [(] 3 [−] 4 [÷] 5 [)]

① ② ③ ④

Pressing the [)] key executes the calculation of 3 − 4 ÷ 5 in the parentheses, leaving 2 calculations pending.

- Parentheses can be used unless pending calculations exceed 4. However, parentheses can be continuously used up to 15 times.

  Ex. Parentheses, if continued, can be used up to 15.

  $1 \times (((2 - 3 \times (((4 + 5) \times 6) \div 7$ .....

End of Supplementary 1

4. Memory Calculations

The independently accessible memory is indicated by the three keys: [x→M] , [RM] , [M+] . Before starting a calculation clear the memory by pressing [C] and [x→M] . (or [CA] key)

Key in: 12 [+] 5 [=] [M+] Answer: 17

To subtract key in: 2 [+] 5 [=] [+/−] [M+]

Answer to this equation: −7

Key in [RM] to recall memory: Display: 10

Key in: 12 [X] 2 [=] [x→M]

Answer: 24 (Replaces previous amount stored in memory with 24.)

Key in: 8 [÷] 2 [=] [M+]

Answer: 4 Key in: [RM] Answer: 28

Note:
- Memory calculations are impossible in the statistical calculation and complex number modes.
- When subtracting a number from the memory, press the [+/−] and [M+] keys.

Press the [2ndF] [TAB F↔E] and [•] keys to calculate in the floating decimal system. (See "Decimal Places")

1. Second Function

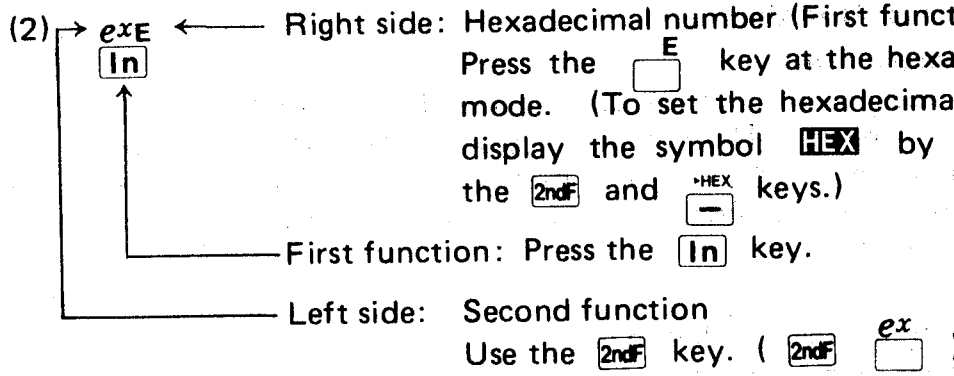
EL-545 has many preprogrammed functions, but the space on the keys to display all the functions is limited. Most of the keys serve two functions: the first function is displayed on the key itself, the second is printed in brown above the key panel.

The yellow key in the upper left of the calculator marked "2nd F" must be used to designate a second function (The material appearing in brown above each key).

Example: (1) [1/x] [x²]

← Second function: Use the [2ndF] key. ([2ndF] [1/x])

← First function: Press the [x²] key.



When the 2ndF key is depressed, the designation "2nd F" will appear in the upper part of the display. If you press this key in error, press it a second time and the "2nd F" designation will disappear.

In this manual, we will always shown key functions as follows;

2ndF sin^{-1} sin → 2ndF sin^{-1} sin^{-1} sin → sin

2. Scientific Notation

Decimal Places

The [2ndF] [TAB] keys are used to specify the number of decimal digits in the calculation result. The number of places after the decimal point is specified by the numeral key ([0] ~ [9]) pressed after the [2ndF] [TAB] keys. Carry over will be automatically rounded. For free floating calculation press the [•] key after the [2ndF] [TAB] keys.

First press [2ndF] [TAB] [•] Key in: [C] 1.23456789 [=]

Display reads 1.23456789

Press [2ndF] [TAB] [3] , display reads 1.235

Press [2ndF] [TAB] [7] , display reads 1.2345679

Press [2ndF] [TAB] [•] , display reads 1.23456789

Scientific Notation

People who need to deal with very large and very small numbers often use a special format called exponential or **scientific notation**. In scientific notation a number is broken down into two parts.

The first part consists of a regular decimal number between 1 and 10. The second part represents how large or small the number is in powers of 10.

If you wish to place a number into the calculator in scientific notation you must use the [EXP] key. If you wish to convert from floating decimal to scientific notation, you must use the [F↔E] key.

Calculate $1.2 \times 10^{20} \times 1.5 \times 10^{5}$

Key in: 1.2 [EXP] 20 [X] 1.5 [EXP] 5 [=]

Answer: 1.8 25 (1.8×10^{25})

Calculate $1.992 \times 10^{33} \times 6.668 \times 10^{-23}$

Key in: 1.992 [EXP] 33 [X] 6.668 [EXP] 23 [+/-] [=]

Answer: 1.3282656 11 (1.3282656×10^{11})

If a calculation is displayed in the floating decimal point system, pushing the [F↔E] key displays the result in scientific notation. Pushing the key again displays the result in the floating decimal point system.

Key in: [C] 1234567898 [=]
Display reads: 1234567898.
Press [F↔E] Display reads 1.2345678 09
Press [F↔E] Display reads 1234567898.

3. Trigonometric functions

Before starting a calculation, designate a desired angular mode.

The angular mode is designated by the [DRG] key. As you press this key the mode "DEG", "RAD", "GRAD" will appear at the upper part of the display.

Put the angular mode at "DEG".

Calculate: Sin 30° + Cos 40°

Key in the following: 30 [sin] [+] 40 [cos] [=]

Answer: 1.266044443

Calculate: Cos 0.25π

Put the angular mode at "RAD".

Key in: .25 [×] [2ndF] [π] [=] [cos]

Answer: 0.707106781

4. Inverse Trigonometric Functions

Calculate: $\text{Sin}^{-1}\ 0.5$

Put the angular mode at "DEG".

Key in: .5 [2ndF] [sin⁻¹]

Answer: 30

Calculate: $\text{Cos}^{-1}\ -1$

Put the angular mode at "RAD".

Key in: 1 [+/−] [2ndF] [cos⁻¹]

Answer: 3.141592654 (Value of π)

To enter a negative number, press the [+/−] key after numerals.

5. Hyperbolic and Inverse Hyperbolic Functions

When using the hyperbolic and inverse hyperbolic functions "HYP" will appear in the upper part of the display.

Calculate: Sinh 4

Key in: 4 [hyp] [sin]

Answer: 27.2899172

Calculate: $\text{Sinh}^{-1}\ 9$

Key in: 9 [2ndF] [archyp] [sin]

Answer: 2.893443986

6. Power Functions

Calculate: 20^2

Key in: 20 [x^2]

Answer: 400

Calculate: 3^3 and 3^4

Key in: 3 [y^x] 3 [=]

Answer: 27

Key in: 3 [y^x] 4 [=]

Answer: 81

7. Roots

Calculate: $\sqrt{25}$

Key in: 25 [$\sqrt{\ }$]

Answer: 5

Calculate: Cube root of 27

Key in: 27 [2ndF] [$\sqrt[3]{}$]

Answer: 3

Calculate fourth root of 81

Key in: 81 [2ndF] [$\sqrt[x]{y}$] 4 [=]

Answer: 3

8. Logarithmic Functions

Calculate: ln 21, log 173

Natural Logarithms: Key in: 21 [ln]

Answer: 3.044522438

Common Logarithms: Key in: 173 [log]

Answer: 2.238046103

9. Exponential Functions

Calculate: $e^{3.0445}$

Key in: 3.0445 [2ndF] [e^x]

Answer: 20.99952881 (21 as in item "8" above)

Calculate: $10^{2.238}$

Key in: 2.238 [2ndF] [10^x]

Answer: 172.9816359 (173 as in item "8" above)

10. Reciprocals

Calculate: 1/6 + 1/7

Key in: 6 [2ndF] [$1/x$] [+] 7 [2ndF] [$1/x$] [=]

Answer: 0.309523809

11. Factorial

Calculate: 69!

Key in: 69 [2ndF] [$n!$]

Answer: 1.7112245 98 (1.7112245×10^{98})

Note that the Error section deals with the calculation limits of the calculator.

12. Percent calculations

Calculate: What is 10% of 200?
Key in: 200 [×] 10 [2ndF] [%] [=]
Answer: 20

Calculate: 9 equals what percent of 36?
Key in: 9 [÷] 36 [2ndF] [%] [=]
Answer: 25 (%)

Calculate: A 10% add-on to 200
Key in: 200 [+] 10 [2ndF] [%] [=]
Answer: 220

Calculate: A 20% deduction on 500
Key in: 500 [−] 20 [2ndF] [%] [=]
Answer: 400

13. Random number generation

Random numbers are useful for "sampling" in statistical calculations. Each time the [2ndF] and [RND] keys are pressed random numbers are generated.

The range of the generated random number is 0.000 ~ 0.999.

Key in: [2ndF] [RND]

Answer: 0.166

Key in: [2ndF] [RND]

Answer: 0.840

Note:

Since random numbers are literally generated at random, you can not expect the same numbers as shown above.

14. Angle/Time conversions

To convert an angle given as degree/minutes/seconds to its decimal equivalent, it must be entered as integer and decimal, respectively.

Convert 12°47'52" to its decimal equivalent

Key in: 12.4752 [•DEG]

Answer: 12.79777778

When converting decimal degrees to the equivalent degrees/minutes/seconds, the answer is broken down: integer portion = degrees; 1st and 2nd decimal digits = minutes; 3rd and 4th digits = seconds; and the 5th and 6th digits = decimal seconds.

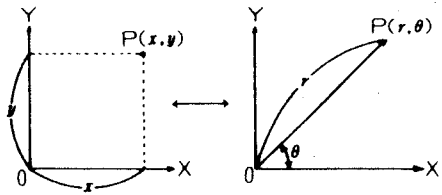
Note:
The decimal portion of the result will be displayed in the 6 digits. (except when the integer portion exceeds 5 digits.)

Convert 24.7256 to its degree/minute/second equivalent
Key in: 24.7256 [2ndF] [°DMS]
Answer: 24.433216 or 24°43'32"

A horse has track times of 2 minutes 25 seconds, 2 minutes 38 seconds, and 2 minutes 22 seconds. What is the average running time?

Key in: .0225 [°DEG] [+] .0238 [°DEG] [+] .0222 [°DEG] [=]
Answer 1: 0.123611111
Key in: [÷] 3 [=]
Answer 2: 0.041203703
Key in: [2ndF] [°DMS]
Answer 3: 0.022833 or the average time is 2 minutes 28 seconds

15. Coordinate Conversion



Rectangular coordinate

Polar coordinate

$[\rightarrow r\theta]$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1}\frac{y}{x}$$

$[\rightarrow xy]$

$$x = r\cos\theta$$

$$y = r\sin\theta$$

DEG: $0 \leqq |\theta| \leqq 180$

RAD: $0 \leqq |\theta| \leqq \pi$

GRAD: $0 \leqq |\theta| \leqq 200$

Converting rectangular coordinates to polar $(x, y \rightarrow r, \theta)$:

Solve for $x = 6$ and $y = 4$ mode = DEG

Key in: 6 [a] 4 [b] [2ndF] [→rθ]

Answer: 7.211102551 (r)

Key in: [b] Answer: 33.69006753 (θ)

- Immediately after completing calculation, the value of r can be recalled with the [a] , and the value θ with the [b] .

Calculate the magnitude and direction (phase) in a vector $\dot{I} = 12 + j9$

Key in: 12 [a] 9 [b] [2ndF] [→r'θ]

Answer: 15 (r)

Key in: [b] Answer: 36.86989765 (θ)

Converting polar coordinates to rectangular (r, $\theta \rightarrow x, y$):

Solve for P (14, π/3), r = 14 $\theta = \pi/3$

Mode = RAD Key in: [C] [2ndF] [π] [÷] 3 [=] [b] 14 [a] [2ndF] [→xy]

Answer: 7 (x)

Key in: [b] Answer: 12.12435565 (y)

- Immediately after completing calculation, you can recall the value of x with the [a] , and the value of y with the [b] .
- In this example, the value of π / 3 (value of θ) is first entered. This is because the value entered with the [a] or [b] key is cleared if any arithmetic operation is subsequently done. To avoid this, the value of θ is first determined and entered with the [b] key, then the value of r is entered with the [a] key.

Notes:
- If the [a] or [b] key is operated in a half way of other calculation sequence, the intermediate result obtained up to that time or the pending operators reserved within parentheses ( ) will be cleared.
- When in the STAT, BINARY, OCTAL, or HEXADECIMAL mode, coordinate conversion is not possible.

16. Applications

Ex. 1 Base conversion of logarithm

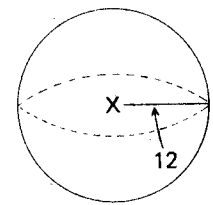
$$\log_a b = \frac{\log b}{\log a} \qquad a = 3,\ b = 124$$

124 [log] [÷] 3 [log] [=]
→ 4.387609364

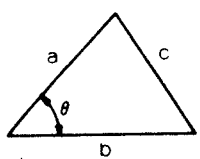
Ex. 2 Calculate the surface and the volume of the sphere.

$S = 4\pi r^2$, $V = \frac{4}{3}\pi r^3$ Radius $r = 12$ cm

4 [×] [2ndF] [π] [×] 12 [x^2] [=]
→ 1809.557368 (S)
12 [y^x] 3 [×] [2ndF] [π] [×]
4 [÷] 3 [=] → 7238.229474 (V)



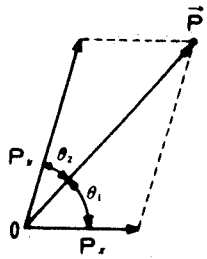
Ex. 3 Cosine theorem



$c = \sqrt{a^2 + b^2 - 2ab\cos\theta}$
$a = 14.7$ cm, $b = 17.8$ cm,
$\theta = 43°32'54''$
Calculate the length c

DEG mode
14.7 [x^2] [+] 17.8 [x^2] [−] 2 [×]
14.7 [×] 17.8 [×] 43.3254 [•DEG]
[cos] [=] [√] → 12.39480134

Ex. 4 Analyze a vector P into two vectors P_x and P_y.



Supposing that P = 22.5 kg, $\theta_1 = 47°$ and $\theta_2 = 24°$, P_x and P_y are determined as follows;

$$P_x = \frac{P \times \sin \theta_2}{\sin (\theta_1 + \theta_2)} \qquad P_y = \frac{P \times \sin \theta_1}{\sin (\theta_1 + \theta_2)}$$

DEG mode

22.5 [÷] [(] 47 [+] 24 [)] [sin] [×]

24 [sin] [=] → 9.678894424 (P_x)

47 [sin] [=] → 17.403633 (P_y)

COMPLEX NUMBER CALCULATION

Complex number calculation:

To carry out complex number calculations, first set the calculator to the Complex number mode (CPLX mode). In the CPLX mode the calculator can perform the four arithmetic functions, as well as, serial calculations. To put the calculator into CPLX mode press the [2ndF] key and the [CPLX] key. A **CPLX** symbol is displayed on the upper right of the screen to show that the calculator is in CPLX mode.
To clear this mode press the [2ndF] key and the [CPLX] key when the **CPLX** symbol is being displayed. (The **CPLX** symbol will disappear.)

A complex number is represented in the a + bi format. The "a" is the real part while the "bi" is the imaginary part. When inputting the real part, after inputting the number press the [a] key. When inputting the imaginary part, after inputting the number press the [b] key. To obtain the result press the [=] key.

The four arithmetic calculations can be performed using the following format:

Addition: $(a + bi) + (c + di) = (a + c) + (b + d)i$

Subtraction: $(a + bi) - (c + di) = (a - c) + (b - d)i$

Multiplication: $(a + bi) \times (c + di) = (ac - bd) + (ad + bc)i$

Division: $(a + bi) \div (c + di) = \frac{ac + bd}{c^2 + d^2} + \frac{bc - ad}{c^2 + d^2} i$

Perform the following calculations.

Calculate: $(5 + 4i) + (6 + 3i)$

Key in: [2ndF] [CPLX] [C]

5 [a] 4 [b] [+] 6 [a] 3 [b]

[=] Display: 11. (real part)

Key in: [b] Display: 7. (imaginary part)

Answer: $11 + 7i$

Key in: [a] Display: 11. (recall the real part)

Key in: [b] Display: 7. (recall the imaginary part)

- Immediately after completing calculation, you can recall the value of the real part with the [a] key, and the value of the imaginary part with the [b] key.
- A value entered with the [a] or [b] key can be corrected simply by typing in the replacement value followed by operation of the [a] or [b] key.

  Example:

  5 [a] → Enters 5 as the real part.
  4 [b] → Enters 4 as the imaginary part.
  6 [a] → Replaces the 5 in the real part with 6.

Calculate: $(5 + 4i) - (6 + 3i)$
Key in: 5 [a] 4 [b] [−] 6 [a] 3 [b]
[=] Display: −1.
Key in: [b] Display: 1.
Answer: $-1 + 1i$

Calculate: $(5 + 4i) \times (6 + 3i)$

Key in: 5 [a] 4 [b] [×] 6 [a] 3 [b]

[=] Display: 18.

Key in: [b] Display: 39.

Answer: 18 + 39i

Calculate: $(5 + 4i) \div (6 + 3i)$

Key in: 5 [a] 4 [b] [÷] 6 [a] 3 [b]

[=] Display: 0.933333333

Key in: [b] Display: 0.2

Answer: 0.933333333 + 0.2i

If the complex numbers are represented as polar coordinates, they are to be input in the following manner. (Refer to the Coordinate Conversion section for an explanation on Polar Coordinates.)

r (cos θ + i sin θ)

Key in: r [a] θ [b] [2ndF] [→xy]

Perform the following example problem.

Calculate: 10 (cos 60° + i sin 60°) + 5 (cos 45° + i sin 45°)

Key in: First, using the [DRG] key, set the calculator into the desired angular mode. In this example set it to the DEG mode, next press [2ndF] [CPLX] [C] . (Display the symbol **CPLX** .)

Key in: 10 [a] 60 [b] [2ndF] [→xy] [+]
5 [a] 45 [b] [2ndF] [→xy]
[=] Display: 8.535533906

Key in: [b] Display: 12.19578794

Answer: 8.535533906 + 12.19578794i

If the answer is to be in polar coordinates, the following operation is to be performed.

Key in: [2ndF] [→r'θ] Display: 14.88598612 (r)

Key in: [b] Display: 55.01276527 (θ)
Answer: 14.88598612 (cos 55.01276527° + i sin 55.01276527°)

Notes:

- In complex number calculation mode (CPLX mode) the four arithmetic functions and coordinate conversion calculations can be performed.
- In complex calculation mode (CPLX mode) memory calculations, constant calculations, and calculations with parenthesis can not be performed.
- If either "a" or "b" is 0 the calculation can be performed without input. However, if "a" and "b" are both 0, one or the other must be input for one of the four arithmetic functions (+, −, x, ÷) to be carried out.

BINARY, OCTAL, AND HEXADECIMAL NUMBER CALCULATIONS

The EL-545 performs normal calculations with decimal numbers, but may also handle binary, octal, and hexadecimal numbers. When performing calculations in each system, first set the calculator in the desired mode before entering numbers. This calculator performs the following calculations in each mode in the same manner that it performs them in decimal mode: basic calculations, calculations with parenthesis, memory calculations, and constant calculations.

The Mode Setting Operation

Binary system mode (BIN):

Press the [2ndF] and [→BIN] keys.

- To show that the calculator is set in the binary mode, the BIN symbol appears on the top part of the display.
- In this mode each column is either a 0 or a 1. In other words only a 0 or 1 can appear in this position. (The [2] ~ [9] keys become invalid.)

Octal system mode (OCT):

Press the [2ndF] and [→OCT] keys.

- To show that the calculator is set in the octal system, the **OCT** symbol appears.
- In this mode each column can have a value from 0 ~ 7. Thus, only the keys [0] ~ [7] are valid. The [8] and [9] keys become invalid.

Decimal system mode (Normal mode, DEC):

Press the [2ndF] and [→DEC] keys.

- In this mode the following symbols do not appear: **BIN** , **OCT** , and **HEX** .
- In normal mode each column can have the value 0 ~ 9.
- In this mode scientific calculations can be performed.

Hexadecimal system mode (HEX):

Press the [2ndF] and [→HEX] keys.

- To show that the calculator is set in the hexadecimal system, the **HEX** symbol appears.

- In this mode each column can have the values 0 ~ 9 or A(10), B(11), C(12), D(13), E(14), F(15).
- When A ~ F is to be input in HEX mode, if the [EXP], [y^x], [$\sqrt{\ }$], [→DEG], [ln], [log] keys are pressed the letters appearing on the upper right corners will be input.

Now try to convert the decimal values 18 and 63 into the various systems. If the **BIN**, **OCT**, or **HEX** symbol is being displayed, press the [2ndF] and [→DEC] keys to enter decimal mode.

Conversion to BINary number

Key in:	18 [2ndF] [→BIN]	Answer: 10010
	[2ndF] [→DEC] 63 [2ndF] [→BIN]	Answer: 111111

Conversion to OCTal number

Key in:	[2ndF] [→DEC] 18 [2ndF] [→OCT]	Answer: 22
	[2ndF] [→DEC] 63 [2ndF] [→OCT]	Answer: 77

Conversion to HEXadecimal number

Key in: [2ndF] [→DEC] 18 [2ndF] [→HEX] Answer: 12

[2ndF] [→DEC] 63 [2ndF] [→HEX] Answer: 3F

Now perform "18 + 63" using the values of each system.

Key in: Binary system [2ndF] [→BIN] [C] (Clears the previously entered data.)

10010 [+] 111111 [=] Answer: 1010001

(If the [2ndF] and [→DEC] are pressed, the results of the decimal system can be viewed.)

Key in: Octal system

[2ndF] [→OCT] [C]

22 [+] 77 [=] Answer: 121

Key in: Decimal system

[2ndF] [→DEC] [C]

18 [+] 63 [=] Answer: 81

Key in: Hexadecimal system

2ndF →HEX C

12 + 3F = Answer: 51

Examples: Mixed calculations

① Calculate ABCD (hexadecimal number) + 10 (decimal number) and output it in hexadecimal numbers.

Key in: 2ndF →HEX C A B C D + 2ndF →DEC

10 = 2ndF →HEX

↑ Then convert it to the system of the the value to be entered.

Answer: Abd7

② Calculate A B C D (hexadecimal number) x 2 (decimal number) and output it in hexadecimal numbers.

Key in: 2ndF →HEX C ABCD × 2ndF →DEC

2 = 2ndF →HEX

Answer: 1579A

- In the Binary, Octal and Hexadecimal system a negative number will be displayed in the each complement form.

Example: [2ndF] [→DEC] 1 [+/−] → −1.

[2ndF] [→BIN] → 1111111111. (2'complement)

[2ndF] [→OCT] → 7777777777. (8'complement)

[2ndF] [→HEX] → FFFFFFFFFF. (16'complement)

- In the Binary, Octal and Hexadecimal system pressing the [+/−] key changes the number displayed from normal form to complement form or vice versa.

Example: [2ndF] [→BIN] 111 → BIN 111. (7)

[+/−] → BIN 1111111001. (−7)

[+/−] → BIN 111. (7)

Table of Values for Four Base Systems

Decimal	Binary	Octal	Hexadecimal
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5

Decimal	Binary	Octal	Hexadecimal
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10
17	10001	21	11
18	10010	22	12
19	10011	23	13
20	10100	24	14

Notes:

- **Scientific calculations can be performed only in decimal system mode.**
- The number of parentheses that can be used in a single calculation and the level of a pending operation are the same as with decimal system calculation.
- When a decimal number having a fractional part is converted into a binary, octal, or hexadecimal number, the fractional part will be truncated, with only the integer part converted into the respective notation.

  Example: [2ndF] [→DEC] 12.34 [2ndF] [→HEX] → HEX C.
  [2ndF] [→DEC] → 12.

- If the result of conversion is outside the calculation range, an error will result. In this case, however, mode switching is effective.

  Example: [2ndF] [→DEC] 512 → 512.
  [2ndF] [→BIN] → E BIN 0.

- If the result or intermediate result of binary, octal or hexadecimal calculation includes a fractional part, that fractional part will be truncated.

  Example: [2ndF] [→OCT] 5 [÷] 2 [=] → OCT 2.

STATISTICAL CALCULATION

- To set the statistical calculations mode, press the [2nd F] and [STAT] keys, the designation " STAT " will appear in the upper part of the display.
- When the statistical calculation mode is set, the following calculations can not be calculated:
  i) Memory calculation
  ii) Coordinate conversion
  iii) Calculation including parenthesis.
  iv) Complex number calculation.
  v) Binary, octal, hexadecimal number calculation.
- The followings can be used as the input data in statistical calculation:
  i) Entry number
  ii) Calculated result of the functions which can be used in the chain calculation.

- To clear previous statistical inputs and calculation press the [2ndF] and [STAT] keys or the [CA] key.
  Then set the mode by pressing the [2ndF] and [STAT] keys again.
- Reset of the statistical calculation mode can be made by the [2ndF] and [STAT] keys or the [CA] key.
  (In the case of pressing the [CA] key, the contents of the memory is cleared.)

Calculate the following statistics.

(1) n: Number of samples

(2) Σx: Total of samples

(3) $\bar{x}$: Mean value of samples ($\bar{x} = \frac{\Sigma x}{n}$)

(4) Σx^2: Sum of squares of samples

(5) s: Standard deviation with population parameter taken to be "n−1".

$$s = \sqrt{\frac{\Sigma x^2 - n\bar{x}^2}{n-1}}$$

(Used to estimate the standard deviation of population from the sample data extracted from that population.)

(6) σ : Standard deviation with populations parameter taken to be "n".

$$\sigma = \sqrt{\frac{\Sigma x^2 - n\bar{x}^2}{n}}$$

(Used when all populations are taken to be sample data or when finding the standard deviation of populations with sample taken to be a populations.)

Data for one-variable statistic calculations are inputted by the following operations.

(1) Data [DATA]

(2) Data [×] Frequency [DATA] (when two or more same data are inputted)

Example:

Calculate standard deviation, mean, and variance $(s)^2$ from the following data:

Value	35	45	55	65
Frequency	1	1	5	2

As each sample is entered the number of that sample will appear on the right hand side of the display.

Key in:	Display:
2ndF STAT	
2ndF TAB •	
35 DATA	1.
45 DATA	2.
55 × 5 DATA	7.
65 × 2 DATA	9.

	Key in:	Display:
Mean ($\bar{x}$):	$\bar{x}$	53.88888889
Standard Deviation (s):	s	9.279607271
Variance:	x^2	86.1111111

Correct Data (CD): The last entry above is an error and must be changed to 60 x 2.

Key in:	Display:
65 × 2 2ndF CD	7.
60 × 2 DATA	9.

ERRORS

In the case of an error, the display will show "E". An error will be caused by a calculations or instruction beyond the capacity of the machine. An error can be cleared by the [C] or [CA] key. (In the case of pressing the [CA] key to contents of the memory is cleared.)

Supplementary 2 — Error Conditions

1. When the absolute value of a calculation result is greater than or equals to 1×10^{100}.
2. When a number is divided by 0 (zero). (Ex. 5 [÷] 0 [=])
3. When the absolute value of a result of memory calculation is greater than or equals to 1×10^{100}.
4. When the pending operation exceeds 4 levels or when the [(] key is depressed 16 times or more in 1 level.
5. For scientific functions, complex number calculation and binary/octal/hexadecimal number calculation, an error occurs when the calculations exceed the following ranges:

CALCULATION RANGE

- The entry and four (4) arithmetic calculations:
  Entry, 1st operand, 2nd operand: $\pm 1 \times 10^{-99} \sim \pm 9.999999999 \times 10^{99}$ and 0
  Calculated result: $\pm 1 \times 10^{-99} \sim \pm 9.9999999 \times 10^{99}$ and 0
  Note: When the absolute value of an entry and a calculation is less than 1×10^{-99}, the calculator assumes the value is 0.
- Scientific and special functions:

Functions	Dynamic range
$\sin x$ $\cos x$ $\tan x$	DEG: $\lvert x \rvert < 1 \times 10^{10}$ RAD: $\lvert x \rvert < \frac{\pi}{180} \times 10^{10}$ GRAD: $\lvert x \rvert < \frac{10}{9} \times 10^{10}$ — to be continued —

Functions	Dynamic range
$\sin x$ $\cos x$ $\tan x$	In $\tan x$, however, the following cases are excluded. DEG: $\lvert x \rvert = 90\ (2n - 1)$ RAD: $\lvert x \rvert = \frac{\pi}{2}\ (2n - 1)$ (n: integer) GRAD: $\lvert x \rvert = 100\ (2n - 1)$
$\sin^{-1} x$ $\cos^{-1} x$	$-1 \leqq x \leqq 1$
$\tan^{-1} x$	$\lvert x \rvert < 1 \times 10^{100}$
$\ln x$ $\log x$	$1 \times 10^{-99} \leqq x < 1 \times 10^{100}$
e^x	$-1 \times 10^{100} < x \leqq 230.2585092$
10^x	$-1 \times 10^{100} < x < 100$

Functions	Dynamic range
y^x	• $y > 0$: $-1 \times 10^{100} < x \log y < 100$ • $y = 0$: $0 < x < 10^{100}$ • $y < 0$: x: integer or $\frac{1}{x}$: odd number $(x \neq 0)$, and $-1 \times 10^{100} < x \log \lvert y \rvert < 100$
$\sqrt[x]{y}$	• $y > 0$: $-1 \times 10^{100} < \frac{1}{x} \log y < 100, \quad x \neq 0$ • $y = 0$: $0 < x < 10^{100}$ • $y < 0$: x: odd number or $\frac{1}{x}$: integer $(x \neq 0)$, and $-1 \times 10^{100} < \frac{1}{x} \log \lvert y \rvert < 100$
sinh x cosh x tanh x	$-227.9559242 \leqq x \leqq 230.2585092$

Functions	Dynamic range
$\sinh^{-1} x$	$\lvert x \rvert < 1 \times 10^{50}$
$\cosh^{-1} x$	$1 \leqq x < 1 \times 10^{50}$
$\tanh^{-1} x$	$\lvert x \rvert < 1$
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{100}$
x^2	$\lvert x \rvert < 1 \times 10^{50}$
$\frac{1}{x}$	$\lvert x \rvert < 1 \times 10^{100}$, $x \neq 0$
n!	$0 \leqq n \leqq 69$ (n: integer)

Functions	Dynamic range
→DEG →D.MS	$\|x\| < 1 \times 10^{10}$ ● The function will remain ineffective for any number outside this range (but error symbol "E" will not appear).
$x, y \rightarrow r, \theta$	$\|x\| < 1 \times 10^{50}$, $\|y\| < 1 \times 10^{50}$ $x^2 + y^2 < 1 \times 10^{100}$ $\left\|\frac{y}{x}\right\| < 1 \times 10^{100}$
$r, \theta \rightarrow x, y$	$0 \leqq r < 1 \times 10^{100}$, θ is in the same condition as x of $\sin x$, $\cos x$.
DRG ▶	DEG → RAD: $\|x\| < 1 \times 10^{100}$ RAD → GRAD: $\|x\| \leqq 1.570796326 \times 10^{98}$ GRAD → DEG: $\|x\| < 1 \times 10^{100}$

Functions	Dynamic range
→DEC →BIN →OCT →HEX (Conversion)	Converted result: DEC: $\lvert x \rvert \leqq 9999999999$ BIN: $1000000000 \leqq x \leqq 1111111111$ $0 \leqq x \leqq 111111111$ OCT: $4000000000 \leqq x \leqq 7777777777$ $0 \leqq x \leqq 3777777777$ HEX: $FDABF41C01 \leqq x \leqq FFFFFFFFFF$ $0 \leqq x \leqq 2540BE3FF$
Binary/octal/ hexadecimal number calculation	Entry and calculation result are in the same conditions as above conversion.

Functions		Dynamic range
Complex number		$(A + Bi) \begin{matrix} + \\ - \\ \times \\ \div \end{matrix} (C + Di)$:
	Addition Subtraction	$\lvert A \pm C \rvert < 1 \times 10^{100}$ $\lvert B \pm D \rvert < 1 \times 10^{100}$
	Multiplication	If the result or intermediate result of the calculation $(AC - BD)$ or $(AD + BC)$ is assumed to be "x": $\lvert x \rvert < 1 \times 10^{100}$
	Division	If the result or intermediate result of the calculation $(AC + BD)/(C^2 + D^2)$ or $(BC - AD)/(C^2 + D^2)$ is assumed to be x: $\lvert x \rvert < 1 \times 10^{100}$ (where $C^2 + D^2 \neq 0$)

Functions	Dynamic range
Statistical calculation	DATA: $\lvert x \rvert < 1 \times 10^{50}$ CD: $\lvert \Sigma x \rvert < 1 \times 10^{100}$ $\lvert n \rvert < 1 \times 10^{100}$ $\Sigma x^2 < 1 \times 10^{100}$ $\bar{x}$: $n \neq 0$ S : $0 \leqq \frac{\Sigma x^2 - n\bar{x}^2}{n-1} < 1 \times 10^{100}$, $n \neq 1$ σ : $0 \leqq \frac{\Sigma x^2 - n\bar{x}^2}{n} < 1 \times 10^{100}$, $n \neq 0$

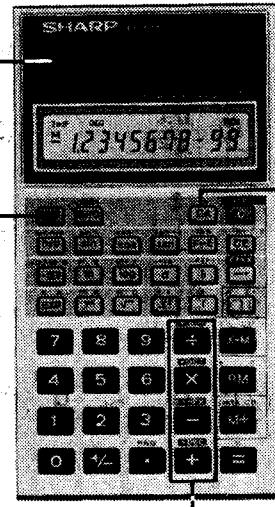
For the accuracy of functions other than show above, the error is ±1 at the 10th digit, as a rule. (In the scientific notation system, the error is ±1 at the lowest digit of mantissa display.)
However, the accuracy will become low around singular points and inflection points of functions.

Therefore, errors are accumulated in each stage of the continuous calculations, causing the accuracy to deteriorate.

End of Supplementary 2 – Error Conditions

Supplementary 3 – Detailed reviews

THE KEYBOARD



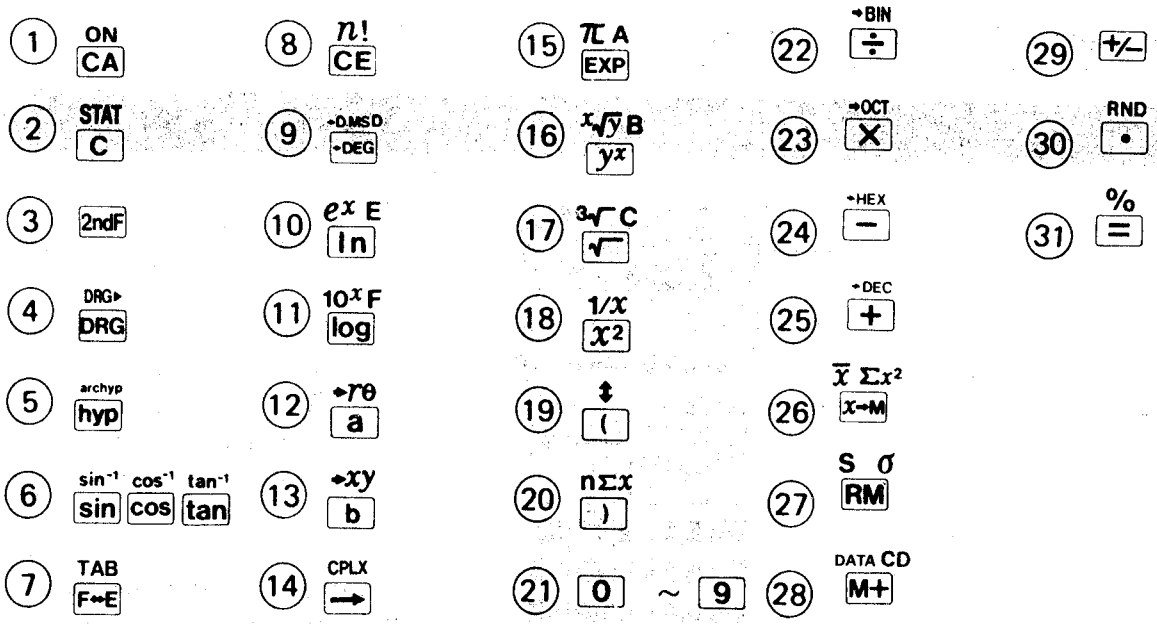
Solar cell

2nd function designation key

Clear all/power-on key

- No Off Key installed. The calculator is turned off when the wallet is closed.

Four arithmetic functions/ binary · octal · decimal · hexadecimal system keys.


1 ON CA
2 STAT C
3 2ndF
4 DRG▸ DRG
5 archyp hyp
6 sin⁻¹ cos⁻¹ tan⁻¹ sin cos tan
7 TAB F↔E
8 n! CE
9 ▸D.MS D ▸DEG
10 eˣ E ln
11 10ˣ F log
12 ▸rθ a
13 ▸xy b
14 CPLX →
15 π A EXP
16 ˣ√y B yˣ
17 ³√ C √
18 1/x x²
19 ↕ (
20 nΣx)
21 0 ~ 9
22 ▸BIN ÷
23 ▸OCT ×
24 ▸HEX −
25 ▸DEC +
26 x̄ Σx² x→M
27 S σ RM
28 DATA CD M+
29 +/−
30 RND •
31 % =

OPERATING CONTROLS

① ON CA

Clear all/Power on key

Before starting calculation, press this key. This causes the numerical values and calculation commands including memory contents to be cleared. At the same time, decimal digits float with the angle unit becoming DEG. (degrees).

Press the ON CA key whenever you see no indication, or meaningless figures or signs despite sufficient light after opening the wallet.

② STAT C

Clear/statistical calculation mode key

C : This is pressed to clear numerical values and calculation commands, except for memory contents, or clear an error.

Example: 5 × 3 ÷ C → 0.

2ndF STAT : Statistical program will be activated.

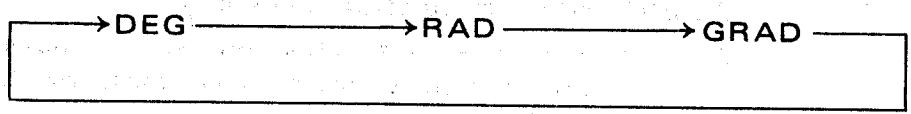
When the calculator is set to the statistical calculation mode through these keys the symbol " STAT " appears, and at the same time the numerical values and calculation commands, except for memory contents are cleared. Meanwhile, in the

statistical calculation mode the [)] , [x→M] , [RM] and [M+] keys work as the [n] , [x̄] , [S] and [DATA] keys, respectively. And pushing these keys immediately after the [2ndF] key they work as the [Σx] , [Σx²] , [σ] and [CD] keys.

③ [2ndF] **2nd function designation key**

④ [DRG▸] [DRG] **Degree/Radian/Grad selector/angular unit conversion key**

[DRG] : Used for calculation of trigonometric, inverse trigonometric and coordinate conversion. The [DRG] key changes the angular mode.



(Press [DRG])

Ex. DEG → GRAD: Depress the [DRG] key twice.

"DEG" mode — Entries and answers are in decimal degrees.
"RAD" mode — Entries and answers are in radians.

"GRAD" mode — Entries and answers are in grads.

$$(100^g = 90^\circ = \frac{\pi}{2})$$

2ndF DRG▸ : It has the function of the DRG key as well as converting the displayed number into a number of the specified angular mode.

⑤ archyp hyp

Hyperbolic/arc hyperbolic key

Example: Refer to pages 29 and 30.

⑥ $\sin^{-1}$ sin, $\cos^{-1}$ cos, $\tan^{-1}$ tan

Trigonometric/inverse trigonometric function key

Example: Refer to Pages 28 and 29.

⑦ TAB F↔E

Display format exchange/Tabulation key

F↔E : **When a calculation result is displayed in the floating decimal point system,** pushing the key displays the result in the scientific notation system.

Pushing the key once more displays the result in the floating decimal point system again.

2ndF TAB : Refer to page 26.

⑧ n! / CE **Clear entry/Factorial key**

CE : Used to clear an incorrectly entered number.

123 + 455 CE 456 = → 579.

2ndF n! : Calculates the factorial of the displayed number.

Factorial of n(n!) = n · (n−1) · (n−2) ····· 2 · 1

Example: Refer to page 32.

⑨ °'"SD / °DEG **Degree/minute/second ↔ Decimal degrees conversion/hexadecimal number key**

°DEG , 2ndF °'" : Example: Refer to pages 34 and 35.

D : Hexadecimal number "D" key.

(effective only in hexadecimal number mode — HEX mode)

(10) e^x E [ln]

Natural logarithm/antilogarithm and hexadecimal number key

[ln] : Used to obtain the logarithm base e (e ≒ 2.718281828).
Example: Refer to page 31.

[2ndF] [e^x] : Calculates the antilogarithm base e of the displayed number.
Example: Refer to page 31.

[E] : HEX mode
Hexadecimal number "E" key.

(11) 10^x F [log]

Common logarithm/antilogarithm and hexadecimal number key

[log] : Used to obtain the logarithm with the base of 10.
Example: Refer to page 31.

[2ndF] [10^x] : Calculates the antilogarithm with the base of 10.
Example: Refer to page 32.

[F] : HEX mode
Hexadecimal number "F" key.

⑫ →rθ [a]

Real number enter/coordinate conversion key

[a] :
- This is used when the real parts of complex numbers are to be inputted and when calling the real parts of calculation results.
- This is used during coordinate conversions when the X coordinate of the Rectangular coordinates (X, Y) is input or when the r of the polar coordinates (r, θ) is input. It is also used for calling the calculated values of X or r.
  Example: Refer to page 36.

2ndF [→rθ] : Converts rectangular coordinate into polar coordinate.
Example: Refer to page 36.

⑬ →xy [b]

Imginary number enter/coordinate conversion key

[b] :
- This is used when the imaginary parts of complex numbers are to be input and when calling the imaginary parts of the calculation results.
- This is used during coordinate conversions when the Y coordinate of the Rectangular coordinates (X, Y) is input or when the θ of the polar coordinates (r, θ) is input. It is also used for calling the calculated values of Y or θ.
  Example: Refer to page 36.

2ndF →xy : Converts polar coordinate into rectangular coordinate.
Example: Refer to page 37.

(14) CPLX →

Right shift/complex number mode key

→ : Example

	Key in		Display
①	12356 → →	→	123.
		45 →	12345.
②	5 EXP 24 → →	→	5. 00
		35 →	5. 35

2ndF CPLX : Used to set the complex number mode.
Example: Refer to page 41.

(15) π A EXP

Enter exponent/Pi and hexadecimal number key

EXP : Example: Refer to page 27.

2ndF π : The constant π ($\pi \fallingdotseq 3.141592654$) is entered.
Example: Refer to page 28.

A : HEX mode
Hexadecimal number "A" key.

⑯ $\sqrt[x]{y}$ B / y^x

Y^x/ $\sqrt[x]{y}$ and hexadecimal number key

[y^x] : Raises a number to a power.
Example: Refer to page 30.

[2ndF] [$\sqrt[x]{y}$] : Calculates the Xth root of Y.
Example: Refer to page 31.

[B] : HEX mode
Hexadecimal number "B" key.

⑰ $\sqrt[3]{}$ C / $\sqrt{}$

Square root/cube root and hexadecimal number key

[$\sqrt{}$] : Calculates the square root of the number displayed.
Example: Refer to page 30.

[2ndF] [$\sqrt[3]{}$] : Calculates the cube root of the number displayed.
Example: Refer to page 31.

[C] : HEX mode
Hexadecimal number "C" key.

⑱ $1/x$ / x^2

Square/reciprocal key

[x^2] : Calculates a square of the number displayed.
Example: Refer to page 30.

2ndF 1/x : Calculates the reciprocal of the number displayed.
Example: Refer to page 32.

(19) ↕ (**Open parenthesis/exchange key**

(: Used to open parenthesis.
Example: Refer to page 17.

2ndF ↕ : Used to exchange the number being displayed with the number stored in the working register. ($x \leftrightarrow y$)

(20) nΣx) **Close parenthesis/statistical calculation key**

) : Used to close parenthesis.
Example: Refer to page 17.

- When the statistical mode is set,

n : Displays the number of samples entered. (n)

2ndF Σx : Used to obtain the sum of the data (Σx).

(21) 0 ~ 9 **Numeral keys**
Used to enter numbers.

→BIN
(22) [÷]

Division/binary number mode key

[÷] : Depressed for division.

2ndF [→BIN] : Used to set the binary system mode.
Converts the number displayed into a number in base 2.

→OCT
(23) [×]

Multiplication/octal number mode key

[×] : Depressed for multiplication.

2ndF [→OCT] : Used to set the octal system mode.
Converts the number displayed into a number in base 8.

→HEX
(24) [−]

Minus/hexadecimal number mode key

[−] : Depressed for subtraction.

2ndF [→HEX] : Used to set the hexadecimal system mode.
Converts the number displayed into a number in base 16.

→DEC
(25) [+]

Plus/decimal number mode key

[+] : Depressed for addition.

2ndF [→DEC] : Used to set the decimal system mode (normal mode). Converts the number displayed into a number in base 10.

$\bar{x}$ Σx^2
(26) [x→M] **Memory-in/statistical calculation key**

[x→M] : Clears the number in the memory and then store the number being displayed in the memory.
To clear the memory depress the [C] key followed by the [x→M] key.

- When the statistical mode is set,

[$\bar{x}$] : Used to obtain the mean value of the data. ($\bar{x}$)

2ndF [Σx^2] : Used to obtain the sum of squares of data. (Σx^2)

S σ
(27) [RM] **Recall memory/statistical calculation key**

[RM] : Displays the contents of the memory. The contents of the memory remain unchanged after this key operation.

- When the statistical mode is set,

[S] : Used to obtain the standard deviation of the sample of data.

2ndF σ : Used to obtain the standard deviation of the population of data.

DATA CD

(28) M+ **Memory plus/DATA CD key**

M+ : Used to add the number being displayed or a calculated result to the contents of the memory.
When subtracting a number from the memory, depress the +/− and M+ keys in this order.

- When the statistical mode is set,

DATA : Used to enter the data (numbers).

2ndF CD : Used to correct the mis-entry. (delete function)

(29) +/− **Change sign key**

Changes the sign of the number displayed from a positive to a negative or vice versa.

Example 5 +/− → −5.

(30) RND [•] Decimal point/random number key

[•] : Example: 12.3 → [1] [2] [•] [3]
0.7 → [•] [7]

[2ndF] [RND] : These keys are used to generate uniform random numbers from 0.000 to 0.999.
Example: Refer to page 33.

Note: Random number generation is not possible when binary/octal/hexadecimal system mode is set.

(31) % [=] Equals/percent key

[=] : Completes four arithmetic calculations (+, −, x, ÷), $\sqrt[x]{y}$, y^x, and complex number calculations.

[2ndF] [%] : Used for the percentage calculation and add-on/discount calculation.
Example: Refer to page 33.

DISPLAY

(1) Display format

(Floating decimal system, normal display)

(Scientific notation system)

Mantissa Exponent

(2) Symbols

— : **Minus symbol**
Indicates that the number in the display following the "—" is a negative.

M : **Memory symbol**
Appears when a number is stored in the memory.

E : **Error symbol**
Appears when an overflow or an error is detected.

2nd F: **2nd function designation symbol**
Appears when the 2nd function is designated.

HYP: **Hyperbolic function designation symbol**
Appears when hyperbolic function is designated.

DEG: **Degree mode symbol**
Appears when the degree mode is designated or shows that the angular mode of the converted result is in degree.

RAD: Radian mode symbol

Appears when the radian mode is designated or shows that the angular mode of the converted result is in radian.

GRAD: Grad mode symbol

Appears when the grad mode is designated or shows that the angular mode of the converted result is in grad.

BIN : Appears when the binary system mode is set or shows the displayed number is a binary number.

OCT : Appears when the octal system mode is set or shows the displayed number is an octal number.

HEX : Appears when the hexadecimal system mode is set or shows the displayed number is a hexadecimal number.

CPLX : Appears when the complex number mode is set.

STAT : Appears when the statistical calculation mode is set.

( ) : **Parenthesis symbol**

Appears when a calculation with parenthesis is performed by depressing the [(] key.

(3) Display system

This machine displays a calculation result (x), if it is within the following range, in the floating decimal point system.

$$0.000000001 \leqq |x| \leqq 9999999999$$

And otherwise the machine displays $|x|$ in the scientific notation system. However a calculation result within the above range is also capable of being displayed in the scientific notation system by pressing the [F↔E] key.

Example: [2ndF] [TAB] [9]

[•] [5] [÷] [9] [=] → 0.055555556
(The 10th decimal place is rounded.)

[F↔E] → 5.5555555−02
(The 10th decimal place of the mantissa is rounded.)

F↔E → 0.055555556

2ndF TAB • → 0.055555555

This is determined by the calculator in the form of $5.55555555556 \times 10^{-2}$. Rounding the 11th digit of the mantissa results in $5.555555556 \times 10^{-2}$. When changed to the floating decimal display, the rounded parts may not be displayed as in this example.

SPECIFICATIONS

Model:	EL-545
Display capacity:	Floating decimal point display: 10 digits or Exponent display: Mantissa 8 digits, Exponent 2 digits
Symbols:	Minus symbol appears both in mantissa and exponents portion, etc. See "DISPLAY"
Calculations:	Four arithmetic calculations, constant calculation, memory calculation, degree/minute/second ⟷ decimal degrees conversion, trigonometric function, inverse trigonometric function, logarithmic function, exponential, square and power, cube root, power root, square root, reciprocal, factorial, coordinates conversion, statistical calculation, hyperbolic and inverse hyperbolic functions, percent calculation, complex number calculation, binary/octal/hexadecimal number calculation, etc.
Component:	LSI etc.

Display:	Liquid crystal (FEM type)
Power supply:	Built-in solar cell
Brightness for operation:	More than 50 lux
Ambient temperature:	0°C ~ 40°C (32°F ~ 104°F)
Dimensions:	69 (W) x 132 (D) x 5.8 (H) mm 2-23/32" (W) x 5-3/16" (D) x 7/32" (H)
Weight:	Approx. 73g (0.16 lbs.)
Accessories:	Leatherette case and instruction manual

End of Supplementary 3

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